Patriot Act Fingerprint Biometrics Evaluation at NIST

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Image Group

IAD-ITL

Outline

- Statutory mandates for Patriot Act testing
- NIST Patriot Act use of fingerprints
- Tests of biometric accuracy
  - FpVTE
  - SDK tests
  - IDENT

Statutory Mandates

- USA Patriot Act (PL 107-56)
- Enhanced Border Security and Visa Entry Reform Act (PL 107-173)
- Develop and certify technology standard to
  - verify identity of foreign nationals applying for a visa
    - visa application at embassies and consulates
    - background check against FBI criminal database and DHS databases and “watch lists”
    - ensure person has not received visa under a different name
  - verify identity of persons seeking to enter the U.S.
    - verify that the person holding the travel document is the same person to whom the document was issued
    - airports, land border crossings, sea entry points

What Test Sample Specifications are Required?

- Data should reflect the image quality that can be achieved using existing sensors in operational government applications.
- One-to-One: Test sample sizes should be 5,000-10,000 individuals.
- One-to-Many: Test sample sizes should be order of 1,000,000 individuals.
- Test samples must contain images of realistic quality .

NIST TEST Datasets

- Used for rolled-rolled, flat-rolled, anr flat to flat testing.
- Approximately 128M images from 18M people.
- Data has both paper and livescan.

Small Datasets

SD 14 (V2)	Ink/Live	Roll:Roll	2,700 Card Pairs	Medium
SD 24	Live (DFR-90)	Plain:Plain	80 Fingers	Good
SD 29	Ink	Roll:Roll Plain:Plain Plain:Roll	216 Card Pairs	Medium
ESD	Live	Plain:Roll	3K Cards	Good
FBI 12K	Ink/Live	Plain:Roll	12K Subjects	Operational
Ohio	Ink/Live	Roll:Roll Plain:Plain Plain:Roll	925 Subjects	Very Good
IDENT/ IAFIS	Live	Plain:Plain Plain:Roll	3.8K Subjects	Operational

Large Two Finger Datasets

INS INDEX (recidivist)	Live (DFR-90)	Index	Plain:Plain	620K Subjects 3M Images	Operational
DOS-BCC	Live (DFR-90)	Index	Plain:Plain	6M Subjects 240K matched	Operational Office
US-VISIT Jan. 04-Feb.04	Live	Index	Plain:Plain	1.4M Subjects 187K matched	Good
US-VISIT Mar. 04-Jun. 04	Live	Index	Plain:Plain	2.8M Subjects 819K matched	Good

Large 10 Print Datasets

INS Benefits	96% Live 14% Rescan	Roll:Roll Plain:Plain Plain:Roll	640K Subjects	Operational (Good)
INS CARD	Ink	Plain:Roll	100K Cards	Operational
TX	60 % Ink 40 % Live	Plain:Roll	500K Cards	Operational
IAFIS-ATB	Ink/Live	Roll:Roll Plain:Roll	1.2M Cards	Operational
IAFIS-NONOPS	Ink/Live	Roll:Roll Plain:Roll	1.7M Cards	Operational
LA County	90% Live 10% Rescan	Roll:Roll Plain:Plain Plain:Roll	1.5M Subjects 73K matched	Operational (Good)
AZ	60 % Ink 40 % Live	Plain:Roll	179K Subjects 100K matched	Operational

FpVTE

- The evaluations were conducted to
  - Measure the accuracy of fingerprint matching, identification, and verification systems
  - Identify the most accurate fingerprint matching systems
  - Determine the viability of fingerprint systems for near-term deployment in large-scale identification systems
  - Determine the effect of a wide variety of variables on matcher accuracy
  - Develop a well-vetted set of a variety of operational data for use in future research

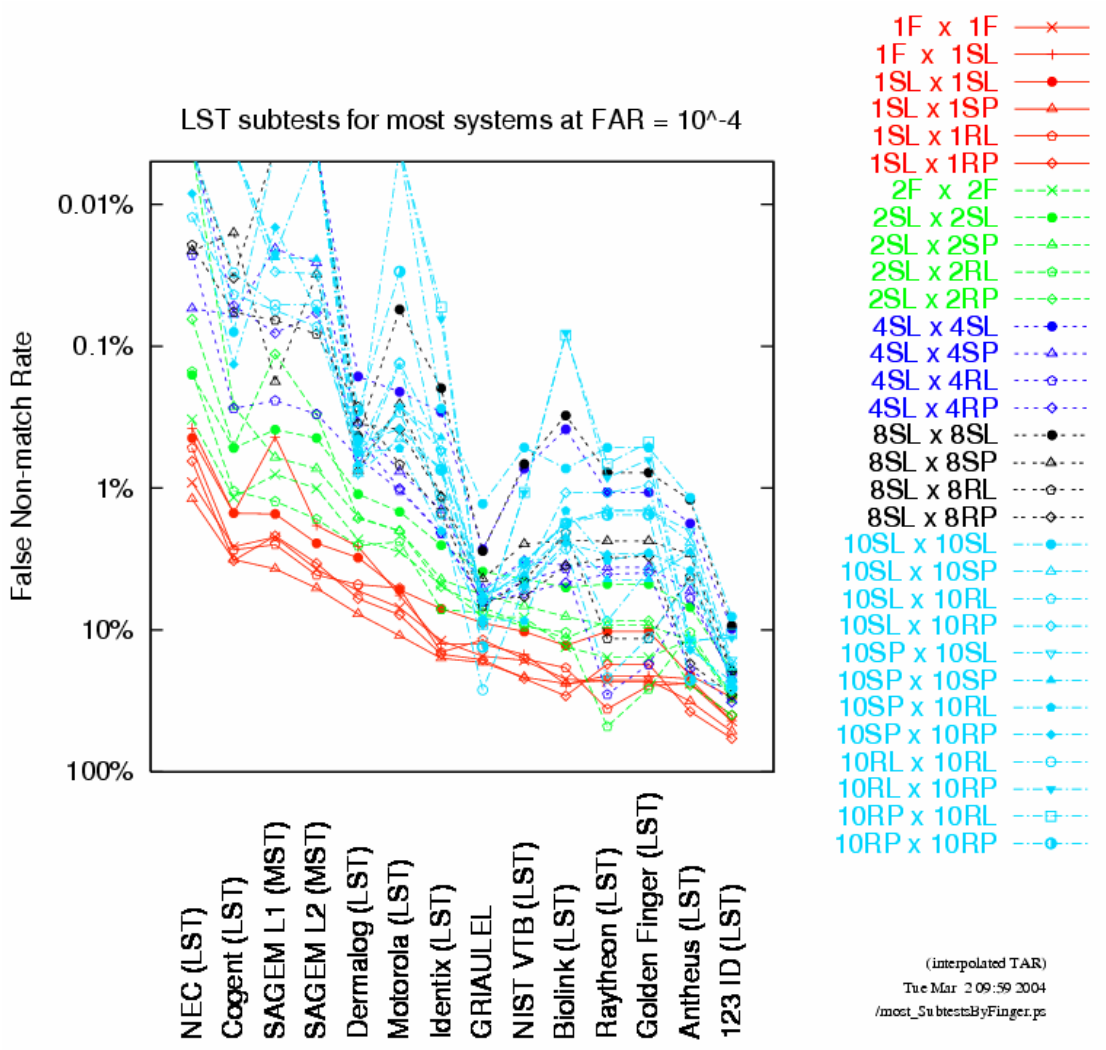
FpVTE (continued)

- The evaluations were ***not*** intended to
  - Measure system throughput or speed
  - Evaluate scanners or other acquisition devices
  - Directly measure performance against very large databases
  - Take cost into consideration

FpVTE- Comparison of Systems

- There is a substantial difference in accuracy between the best systems and the average or worst systems
- The most accurate system were submitted by Cogent, NEC, SAGAM
- The top tier systems are more consistent in performance than the other systems
  - They perform consistently well over a variety of data, and are less affected by fingerprint quality and other variables
- The performance of the most accurate systems has been verified by SDK testing.

More Finger Are More Accurate



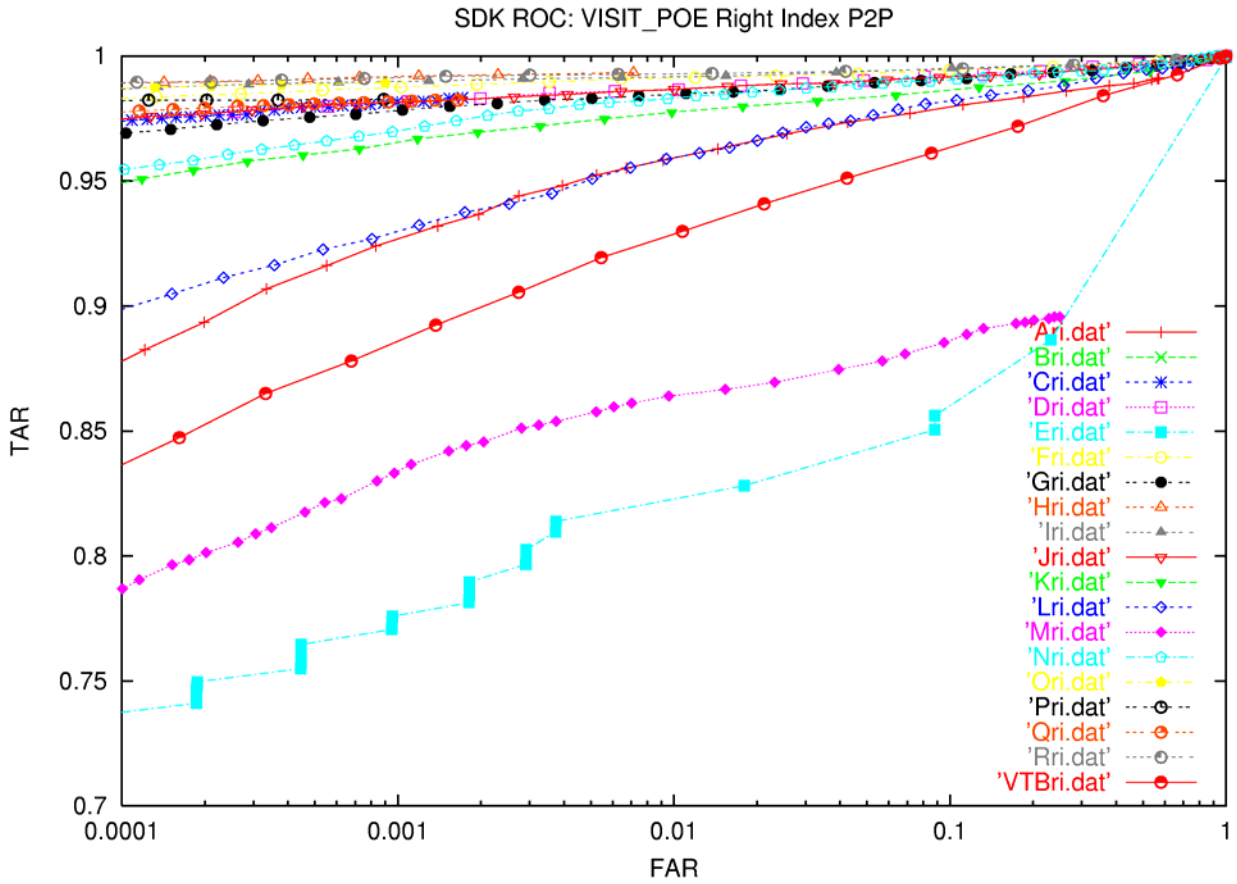
SDK Tests

Medium scale evaluation of
one-to-one matching for:
16 software matchers
20 single finger datasets

Scale of Tests

- Each test involved 36M matches on a 3GHz Pentium platform.
- Gallery 6K probe 6K
- Match time must be less than 10ms per fingerprint pair
- Each test results in an ROC curve

SDK Testing - 19 Algorithms, POE right index, 0.684G matches



SDK LETTER	VENDOR NAME
A	Name Not Released
B	Name Not Released
C	NEC
D	Cogent Systems, Inc.
E	Name Not Released
F	Cogent Systems, Inc.
G	SAGEM Morpho, Inc.
H	NEC
I	Cogent Systems, Inc.
J	SAGEM Morpho, Inc
K	Neurotechnologija Ltd.
L	Name Not Released
M	Name Not Released
N	Dermalog
O	NEC
P	NEC
Q	ID Solutions Inc.
R	Cogent Systems, Inc.
VTB	NIST

SDK - Conclusions

- All vendors are sensitive to image quality.
- Three algorithms vendors are clearly more effective.
- Combining two fingers will provide very effective one-to-one verification for the US-VISIT program TAR 99.6% FAR 0.1%
- The NIST VTB algorithm is better than many commercial products.

US-VISIT IDENT System

- IDENT is the primary fingerprint matcher for US-VISIT
- Three functions:
  - Watch list checking at enrollment
  - Duplicate identification check for visa holders
  - One-to-one verification for enrolled travelers

Conclusions On Accuracy of US-VISIT

- One-to-One
  - TAR of 99.6% at a FAR of 0.1%.
  - This has been tested operationally with an 800K sample size.
- One-to-Many
  - TAR 96% at a FAR of 0.09%
  - This has been tested on a database of 6,000,000
- The System Works